Electronics and Electrical Comm. Dept.
Total Marks: 75 Marks
Second Term

Course Title: **Microwave Engineering**	Course Code: EEC 4232	Year: 4th
Date: 15-6-2017	Allowed Time: 3 Hours	No. of Pages: (2)

Time (3 hours), (Exam in two papers)

Answer the following five questions:

Question (1) **[15 Marks]**

(a) **Draw** the triode equivalent circuit at high frequencies then **Derive** an expression for the triode input impedance. **Comment** on the results.

(b) **Compare** between the efficiencies of DCK, RK, and TWT.

(c) **Compare** between the ordinary diode and the tunnel diode.

Question (2) **[15 Marks]**

(a) **Derive** the relationship between the departure angle and arrival angle in DCK and explain the bunching process.

(b) The parameters of a two cavity klystron amplifier are: $V_0 = 1250\ V$, $I_0 = 25\ mA$, $L = 4.15\ cm$, $f = 3.2\ GHz$, $d = 1\ mm$, effective shunt resistance without the load $R_{sh} = 30.5\ k\Omega$. Determine:

1. Input gap voltage V_1 to give a maximum output voltage V_2.
2. Voltage gain neglecting beam loading on the output cavity.
3. Conversion efficiency of the amplifier.
4. Compute the beam loading conductance and show that it is justified to neglect in the above calculations.
5. Calculate the input power if the loss resistance in the input cavity is $50\ k\Omega$.

Question (3) **[15 Marks]**

(a) **Derive** an expression for the electronic admittance of the RK. **Draw** the electronic admittance. **State** the necessary conditions for oscillations.

(b) **Explain** how the RK operation reaches the steady state.

(c) The parameters of a ***reflex klystron*** are:

$V_0 = 600\ V$, $I_0 = 20\ mA$, $V_r = 250\ V$, $L = 1\ mm$. The transit time effect and beam loading through the gap are neglected. If the RK operates in the lowest order mode calculate.

1- The maximum ac output voltage V_1.

2- The dc round trip time.

3- The oscillation frequency.

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Question (4) **[15 Marks]**

(a) Starting from the TWT characteristic equation

$$jZ_0 I_0 \beta_e \gamma^2 \gamma_0 = 2V_0(\gamma_0{}^2 - \gamma^2)(j\beta_e - \gamma)^2$$

Derive an expression for the three ***forward waves*** propagation constants within the tube. **What happens** if this backward wave reaches the input terminal of the RK.

(b) A travelling wave tube operates under the following parameters:
beam voltage $V_0 = 2500\,V$, beam current $I_0 = 50\,mA$, characteristic impedance of the helix $Z_0 = 6.75\,\Omega$, circuit length $N = 50\,turns$, and the applied signal frequency $f = 8\,GHz$. **Determine:**

1- The gain parameter C.
2- The output power gain.
3- The three forward propagation constants.

Question (5) **[15 Marks]**

(a) **Briefly explain** with the aid of the energy band diagrams the I-V characteristic curve of the tunnel diode only in the negative resistance region V= V_p , $V_p < V < V_v$, and $V = V_v$ **(Three cases only).**

(b) **Draw** the equivalent circuit of the tunnel diode and **derive** an expression for the resistive cutoff frequency.

(c) A tunnel diode has the following parameters; $I_P = 10mA$, $I_V = 0.125mA$, $V_P = 0.237V$, $V_V = 0.4V$, $c_j = 20PF$, $R_s = 1\Omega$, and $L_s = 5nH$ **Find** the resistive cut off frequency and self-resonance frequency.

With my best wishes
Dr/ Amr Hussein

Tanta University

Department: Electronics & Communications Engineering
Programme: Undergraduate
Total Marks: (90) Marks

Faculty of Engineering

Course Title: Mobile Communication Systems | Course Code: EEC4230 | Year: 4th year
Date: 04/06/2017 | Allowed time: 3 hrs. | No. of Pages: (3)

Remarks: (answer all the following questions… assume any missing data… arrange your answer booklet)
You may use the following: $c = 3 \times 10^8$ m/s

Question No. 1 : (18) Marks

a) Explain using a timing diagram how a cellular telephone call is made **to** a mobile.

(5) Marks

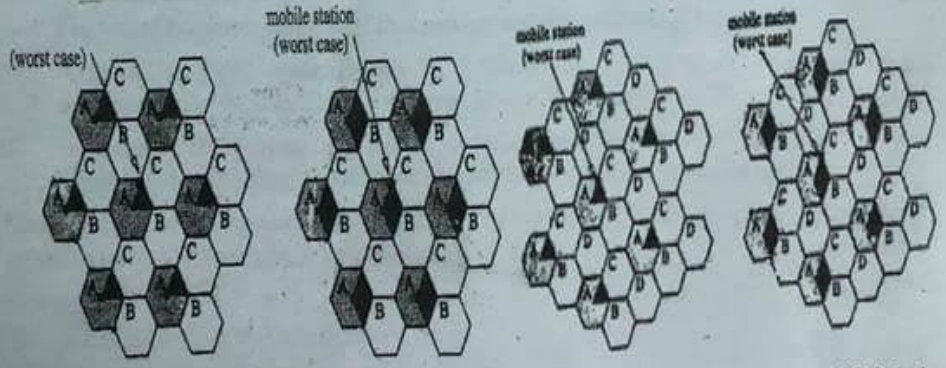
b) Suppose that a cellular system employs the following parameters:

- Cluster size of $N = 7$, pathloss expoenent of $n = 4$, minimum SIR (worst case) of 18.7 dB,
- omni-directional antennas at the base stations.

This system has just reached its maximum capacity and needs to be upgraded by cluster size reduction combined with sectoring. If the link quality must be maintained by ensuring the minimum SIR (worst case) after cluster size reduction and sectoring to be $\geq$ 18.7 dB. (7) Marks

i. Determine the number of interferes (i_0) encountered from the first tier only after clusetr size reduction to $N = 4$ and $N = 3$ for each sectoring scheme, i.e., 60° and 120° as shown below (**validate your answer on a sketch!**).

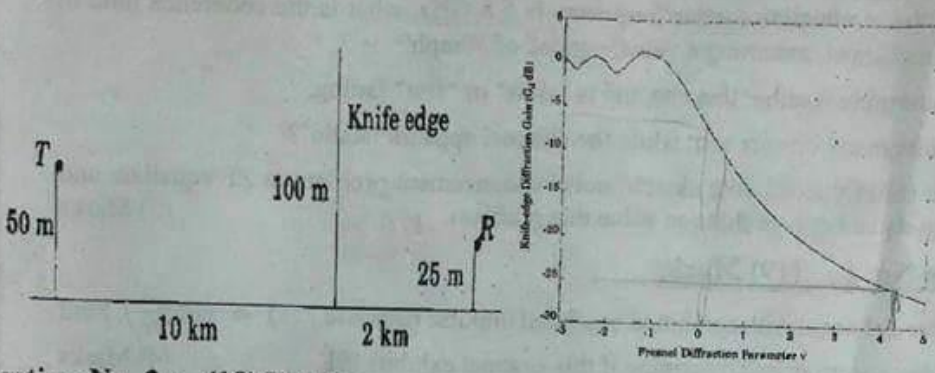
ii. Determine which configuration(s) (cluster size, sectoring scheme) would maintain the link quality $\geq$ 18.7 dB as required (**validate your result assuming equi-distant interferes!**).



c) Given the following geometry and curve, determine: (6) Marks

i. The loss due to knife-edge diffraction, and

ii. The height of the obstacle required to induce 6 dB diffraction loss. Assume f = 900 MHz.



Question No. 2 : (18) Marks

a) Fill in the space in the following statements: (4) Marks

i. Small-scale propagation models are used to characterize the received signal over ....

ii. Scattering occurs when the plane wave are incident upon an object whose dimensions are ....

iii. ... model is used to characterize LOS microcell systems in urban environments.

iv. ... model provides empirical formulation for path loss from 150 to 1500 MHz.

b) Explain (briefly) the following terms: (8) Marks

i. Coherence badnwidth (B_c).

ii. Coherence time (T_c).

iii. Channel impulse response ($h(t,\tau)$).

iv. RMS delay spread (σ_τ).

c) Consider a linear time invariant channel having the impulse response: (6) Marks

$$h(t,\tau) = \delta(\tau) + 2\delta(\tau - \tau_1) + \delta(\tau - 2\tau_1)$$

i. What is the mean delay and rms delay spread of the channel?

ii. Derive a closed-form expression for the channel magnitude response $|H(f)|$ and sketch it.

(***Hint: you may use*** $\cos x = \frac{e^{jnx}+e^{-jnx}}{2}$ ***and*** $\cos 2x = 2\cos^2 x - 1$).

Question No. 3 : (15) Marks

a) Compare between **Rayleigh** fading channel and **Rician** fading channel in terms of: (4) Marks

i. Probability distribution function (pdf) shape.

ii. Signal components.

b) If a baseband binary message with a bit rate $R_b = 100$ Kbps is modulated by an RF carrier using BPSK modulation. (6) Marks

i. If the modulation carrier frequency is 5.8 GHz, what is the coherence time of the channel, assuming a vehicle speed of 30mph?

ii. determine weather this channel is "slow" or "fast" fading.

iii. How many bits are sent while the channel appears "static"?

c) Explain (briefly aided with sketch) noise enhancement problem in ZF equalizer and mention equalizer type that can solve this problem. (5) Marks

Question No. 4 : (19) Marks

a) Consider a channel with combined baseband impulse response $f(t) = sinc(\frac{t}{T_s})$. Find the folded spectrum and determine if this channel exhibits ISI. (4) Marks

b) Compare between selection combining (SC) ,maximum ratio combining (MRC), and equal-gain comining (EGC) in terms of: (9) Marks

i. The combiner output.

ii. Average SNR of combiner output γ_{Σ}.

iii. Need for co-phasing.

c) Draw the transmitter and receiver block diagrams for both a frequency hopping spread spectrum (FHSS) systems and a direct sequence spread spectrum system (DSSS). (6) Marks

Question No. 5 : (20) Marks

a) Discuss (breifly) the three different properties of pseudo-random sequence. (6) Marks

b) Consider an FH system transmitted over a two-ray channel, where the reflected path has relative delay of $\tau = 10\ \mu s$. If the receiver is synchronized to the hopping of the LOS path. (6) Marks

i. For what hopping rates will the system exhibit no fading?

ii. Assume an FFH system with $T_c = 50\mu s$ and $T_s = 0.5\ ms$. Will this system exhibit:(a) no fading, (b) flat fading, or (c) frequency selective fading?

iii. Assume a SFH system with $T_c = 50\mu s$ and $T_s = 0.5\ ms$. Will this system exhibit:(a) no fading, (b) flat fading, or (c) frequency selective fading?

c) Sketch the block diagram of GSM network architecture indicating the different sub-systems and interfaces between blocks. (4) Marks

d) Compare between : (4) Marks

i. HLR and VLR functions.

ii. BTS and BSC functions.

Good luck

Dr. Mahmoud Selim (Coordinator of the Course)

Tanta University

Department: Electronics and Electrical Communications Engineering

Faculty of Engineering

Total Marks: (85) Marks
Final Exam

Course Title: Multimedia and Image Processing (Elective course 4) Course Code: EEC4235 Year: 4rd
Date: 11/06/2017 Allowed time: (3) hrs. No. of Pages: (1)

Please answer the following questions

Question No. 1:

A) Mention the concept of multimedia with addressing the multimedia modalities and its applications.

B) Draw the block diagrams of the image processing system indicating the three processing levels as well as the key stages in the digital image processing system.

C) Explain the processes included in capturing a digital image of a real-world scene.

D) Mention four multimedia software tools.

Question No. 2:

A) What is the main component in the video? Draw the video sequence with time? Explain is the correlation between the frames in a video better to be high or low?

B) Compare between the spatial and frequency domain techniques in image enhancement.

C) Define the histogram and histogram equalization using equations.

D) Draw the histogram distribution as an example for dark image and bright image.

Question No. 3:

A) Derive using equations the Laplacian filter and the Sobel operator for image enhancement.

B) Mention the approaches that can be used to deal with the missing edge pixels.

C) Illustrate with drawing the discrete Fourier transform (DFT) and the transfer function of the Butterworth for image processing.

D) Describe with equations the concept of adaptive median filter and its uses.

Question No. 4:

A) Define the segmentation process. Give an example the design of an edge detection filter.

B) Address the different segmentation techniques with detailed description using their algorithms. Compare between the local and global thresholding.

C) Define the data compression process, its goals and its basic methods. What are the different types of redundancy? Compare between the audio and image compression. Write the steps of the Huffman-coding.

D) Compare between the lossless and lossy compression. What are the different frame types in the Moving Pictures Expert Group (MPEG) technique? What are the benefits of using real time video encoding?

End of Questions

Good luck
Dr. Amira Ashour

Tanta University | Department: Electronics and Electrical Communication Eng. | Faculty of Engineering

Total Marks: 85 Marks

Course Title: Information Theory	**Course Code: EEC4237**	**Year: 4th**
Date: 6/6/2017 (Second Term)	**Allowed time: 3 hours**	**No. of Pages: (2)**

Remarks: (answer the following questions, assume any missing data, answers should be supported by sketches, Neat answers and boxed results are appreciated)

Question (1)

(a) Find the upper limit of capacity for continuous channel.

(b) A terminal is used to enter alphanumeric data into a computer through a telephone channel of 3400 Hz. It is found that the obtained channel rate is 14929 bit/sec. Determine:

(i) S/N in dB.

(ii) If the channel bandwidth is doubled, what will be the required S/N for the same channel rate?

(c) Construct a convolution encoder with the commutator samples $C_1 = D_1$, $C_2 = D_1 \oplus D_2$, and $C_3 = D_1 \oplus D_2 \oplus D_3$. The data input stream is 1011. Find the message coded by the encoder.

Question (2)

(a) Show that the mutual information is symmetrical.

(b) Prove that; $I(X;Y) = H(X) + H(Y) - H(X,Y)$.

(c) For a binary symmetric channel whose input source is the alphabet X = {0, 1} with probabilities {0.5, 0.5} and whose output alphabet is Y = {0, 1}, having the following channel matrix where e is the probability of transmission error:

$$\begin{pmatrix} 1-e & e \\ e & 1-e \end{pmatrix}$$

i. What is the entropy of the source, H(X)?

ii. What is the probability distribution of the outputs, p(Y), and the entropy of this output distribution, H(Y)?

iii. What is the joint probability distribution for the source and the output, p(X,Y), and what is the joint entropy, H(X,Y)?

iv. What is the mutual information I(X;Y) of this channel?

v. How much uncertainty is there about the input symbol once an output symbol has been received? H(X/Y)

vi. What value of e maximizes the uncertainty H(X|Y) about the input symbol given an output symbol?

vii. How many values are there for e for which the mutual information of this channel is maximal? What then is the capacity of such channel?

viii. For what value of e is the capacity of this channel minimal? What is the channel capacity in that case?

Question (3)

(a) Check if the following code $C = \{0, 11, 100, 110\}$ is instantaneous or not? If not; find its instantaneous one.

(b) Compare between GBN ARQ and SR ARQ schemes (answer should be in a table).

(c) Check whether the received signal "0010111010101100" is error-free or not using Hamming code (16, 11) where the Hamming bits are in positions 1, 2, 4, 8, and 16.

(d) Using CRC to detect any error in the received message at a channel output when the data message was "1011011010", using the polynomial $P(x)=x^4+x^3+1$.

Question (4)

(a) Define strong-noise channel and symmetrical one; give an example for each? Write the mathematical expression of each one representing probability and entropy.

(b) Is it possible that a nonzero error pattern can produce zero syndrome? Justify your answer.

(c) The parity check matrix is given by the following

$$H = \begin{bmatrix} 1 & 0 & 1 & 1 & 1 & 0 & 0 \\ 1 & 1 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 & 1 \end{bmatrix}$$

(i) Find the P matrix.
(ii) Find the generator matrix, G.
(iii) What is the dimension of the code?
(iv) Check which of the following is a codeword; (1001011), (0101100), and (1101100)?
(v) What is the information message if the received codeword is "1011110"?
(vi) Does the parity check matrix allow the presence of the codewords of weight less than 3 (apart from the all zero codeword). Why?
(vii) Suppose that the code is used for error detection only over a binary symmetric channel with error rate $p = 10^{-3}$. Find the probability of undetected error.

Best Wishes of Success
Dr. Heba A. El-Khobby

Tanta University

Department of Electronics and Electrical Communication Engineering

Faculty of Engineering

Course: Computer Networks
Date: Thu., 08-June-2017,

Course Code: EEC4231,
Time Allowed: 3 hours,

Students: 4th year
No. of Pages: 2,

Final Exam

(Total Marks: 75 marks)

Answer the following questions:

Question 1: [20 Marks]

a) Find the OSI layer that perform the following functions:

1- Data rate	2- Access control	3- Connection control	4- Grouping
5- Line configuration	6- addressing	7- Flow control	8- Compression

b) A 24 bit data stream, 101100101011100110110101. If the word size is 8 bits (i.e. the stream represents 3 bytes). Find the VLRC. If errors occurred at the bits 3,9,10 counted from the MSB side. Does VLRC capable for error detection and correction for these errors?

c) Compare between the networking devices: routers and gateways.

Question 2: [20 Marks]

a) With the aid of diagrams, describe the different Automatic Repeat Request (ARQ) mechanisms. Deduce the advantages and disadvantages of each technique.

b) Use charts to clarify the types and categories of the multiple access protocols.

c) Compare Pooling to Reservation media access protocols. Use diagrams and flow charts when possible.

d) With the aid of flow charts and performance curves show the differences between the common types of random access techniques. Deduce the suitable network topology for each access protocol stated.

Question 3: [15 Marks]

a) In Fig.1, you have a subnetwork, 192.168.214.0/24. It is divided into subnet A and subnet B. You want to add a third subnet, C, with 10 hosts. Is this possible? If yes, provide the network address (i.e. Subnet ID) of the new subnet you will be adding (i.e. 192.168.2.14).

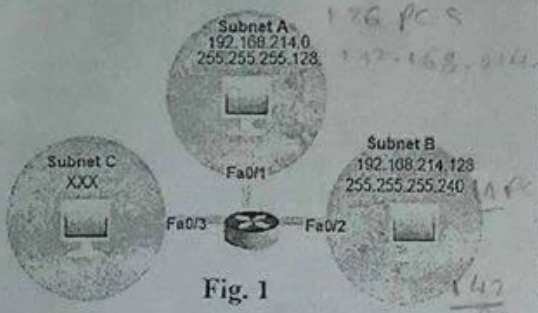


Fig. 1

b) What is the valid host range of the subnet that host 192.168.28.67, 255.255.255.224 is a part of?

c) Based on the information in Fig.2, using the address space 172.16.0.0, design a network addressing scheme that will supply the minimum number of hosts per subnet with the most efficient use of the given addressing space.

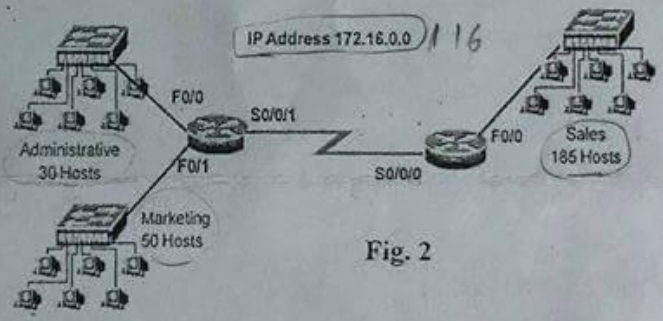


Fig. 2

Question 4: [20 Marks]

a) Compare between the different WLAN's MAC layer management frames in terms of: their purpose, content and the entity (APs or STAs) that is responsible for transmitting each one?

b) Using diagrams, compare the architectures of WiFi access points (AP) and stations (STA).

c) Classify wireless sensor network routing protocol according to: Network organization, Protocol operation.

d) Write short notes on: stages of handshaking phase in SPIN protocol, SPIN's metadata, SPIN protocol families.

With best wishes of success

Dr. Sameh A. Napoleon